



## Model Question Paper

### Sixth Semester BE Degree Examination

### System Engineering

Time: 2.5 Hours(150 Minutes)

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.*

*2. M: Marks, L: RBT (Revised Bloom's Taxonomy) level, C: Course outcomes.*

| Module -1         |    |   | M  | L  | C   |
|-------------------|----|---|----|----|-----|
| Q1                | a. | Explain the importance of physical design in engineering systems and discuss any two objectives of physical design.   | 05 | L2 | CO1 |
|                   | b. | Explain three elements of sensor-actuator systems   | 05 | L2 | CO1 |
|                   | c. | With a neat diagram, explain the conceptual physical design architecture of a Cyber-Physical System.  | 10 | L2 | CO1 |
| <b>OR</b>         |    |   |    |    |     |
| Q2                | a. | List the common types of sensors used in physical systems. Discuss the key design considerations while selecting a sensor as an input component in system engineering applications.   | 05 | L2 | CO1 |
|                   | b. | Discuss the limitations and ambiguity associated with the definition of a sensor as “a device that responds to a physical stimulus and transmits a resulting signal.” Illustrate your answer with a suitable example  | 05 | L2 | CO1 |
|                   | c. | With detailed steps explain how I2C & SPI Communication Protocol Works  | 10 | L2 | CO1 |
| <b>Module- 2</b>  |    |   |    |    |     |
| Q3                | a. | Compare RDBMS and NoSQL with respect to sensor data characteristics in Cyber-Physical Systems.  | 06 | L3 | CO2 |
|                   | b. | Illustrate UNION types (categories) in EER modeling using a Smart Agriculture Cyber-Physical System example   | 05 | L3 | CO2 |
|                   | c. | Design an Enhanced Entity–Relationship (EER) model for an “ <b>automated Aircraft Monitoring &amp; Control</b> ” Cyber-Physical System that includes sensors, actuators, and controllers. Clearly identify the entities, attributes, and relationships. Incorporate appropriate specialization and generalization hierarchies, and specify the constraints on specialization such as disjoint/overlapping and total/partial participation. State clearly any assumptions made in your design. | 09 | L3 | CO2 |
| <b>OR</b>         |    |   |    |    |     |
| Q4                | a. | Identify any 3 functional data requirements & 3 non-functional data requirements for “ <b>Air Quality Monitoring &amp; Control Station</b> ” & justify your answer.   | 06 | L3 | CO2 |
|                   | b. | With an example scenario, Illustrate the need of In-Memory Database based data store & its applicability for Autonomous Military Drone Systems.   | 05 | L3 | CO2 |
|                   | c. | Compare the following concepts with suitable examples, and identify the most appropriate type of data store for each case. Justify your answer.<br>1. Hard Real-Time Systems vs Soft Real-Time Systems<br>2. Push-based vs Pull-based data retrieval models   | 09 | L3 | CO2 |
| <b>Module - 3</b> |    |   |    |    |     |
| Q5                | a. | A Smart Agriculture System requires farmers to monitor soil moisture, temperature, and irrigation status in real time. With an example illustrate how   | 06 | L3 | CO3 |

|                   |    |   |    |    |     |
|-------------------|----|---|----|----|-----|
|                   |    | UI/UX principles can be applied to design a user-friendly interface for this system.  |    |    |     |
|                   | b. | An industrial monitoring system needs to display machine performance and alerts. Compare operational, analytical, and strategic dashboards, and determine which type is most suitable. Justify your answer.   | 06 | L3 | CO3 |
|                   | c. | With an example, illustrate the Design a dashboard for a Smart Agriculture system that supports business decision-making. Identify KPIs, layout, and business value.  | 08 | L3 | CO3 |
| <b>OR</b>         |    |   |    |    |     |
| Q6                | a. | Apply the concept of Hardware User Interface (HUI) to design an interface for a smart irrigation system & illustrate user interaction.  | 06 | L3 | CO3 |
|                   | b. | With an example illustrate how dashboard design principles can be applied to improve a poorly designed IoT dashboard.   | 06 | L3 | CO3 |
|                   | c. | Develop a value-driven dashboard for agricultural analytics. Identify KPIs, user needs, and explain UI/UX integration.  | 08 | L3 | CO3 |
| <b>Module - 4</b> |    |   |    |    |     |
| Q7                | a. | An Air Quality Monitoring & Control Station experiences an increase in sensor deployments across a city. Apply the concept of scalability & illustrate how the system can handle increased data and users.  | 06 | L3 | CO4 |
|                   | b. | A distributed system must ensure availability and consistency. Apply CAP theorem & with an example illustrate the trade-offs in such systems.   | 08 | L3 | CO4 |
|                   | c. | Illustrate how sharding and replication is applied in scalable database architecture to improve performance and reliability of Smart Agriculture CPS.   | 06 | L3 | CO4 |
| <b>OR</b>         |    |   |    |    |     |
| Q8                | a. | With an example, illustrate how principles of scalable system can be applied to design a solution to improve IoT-based monitoring system performance.   | 06 | L3 | CO4 |
|                   | b. | An industrial air quality monitoring system faces server overload due to continuous sensor data streams. Apply & illustrate how load balancing techniques would improve system performance.   | 08 | L3 | CO4 |
|                   | c. | Illustrate various monitoring and performance tuning techniques for scalable systems with examples.   | 06 | L3 | CO4 |
| <b>Module - 5</b> |    |   |    |    |     |
| Q9                | a. | A traffic congestion problem occurs at peak hours in a smart city. Illustrate how Cyber-Physical System architecture can be applied to propose a solution using sensors, communication, and control systems.  | 07 | L3 | CO4 |
|                   | b. | An e-commerce platform experiences a surge in users during a festival sale. Illustrate how scalability concepts can be applied to design system to handle increased traffic, transactions, and data efficiently.                                    | 06 | L3 | CO4 |
|                   | c. | Apply Cyber-Physical System (CPS) concepts to design the architecture of a Smart City Traffic Management System. Illustrate the working of the architecture & system with a neat diagram.   | 07 | L3 | CO4 |
| <b>OR</b>         |    |   |    |    |     |
| Q10               | a. | A wearable health monitoring system must track patient vitals remotely and alert doctors during emergencies. Apply CPS architecture to design a solution using sensing, communication, and actuation components & illustrate the working of system. | 07 | L3 | CO4 |
|                   | b. | Apply scalability concepts & illustrate how Netflix handles global streaming.   | 06 | L3 | CO4 |
|                   | c. | Design a scalable CPS architecture for industrial monitoring including data flow, storage, and analytics & illustrate the working of the system.  | 07 | L3 | CO4 |

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